PATENT ABSTRACTS OF JAPAN

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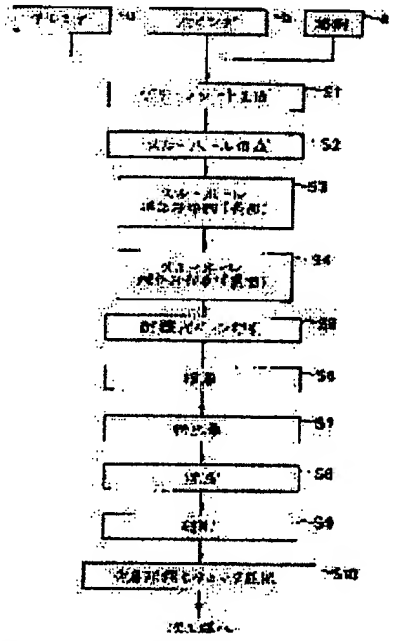
(72)Inventor : YOKOGAWA SAKAE

(54) MULTILAYER CERAMIC WIRING BOARD AND ITS MANUFACTURE

(57)Abstract:
PURPOSE: To improve reliability of continuity of through holes without performing repeated printing to enable through holes to be filled with a sufficient quantity of a conductor paste.
CONSTITUTION: In a process of manufacturing a multilayer ceramic wiring board, a screen of a normal pattern is used to fill all through holes from the surface of a green sheet with a conductor paste. Thereafter, an inverted screen with the normal pattern inverted from left to right is used to fill all through holes from the backside of the green sheet with the conductor paste.



LEGAL STATUS

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[Date of final disposal for application]

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[Date of extinction of right]	

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CLAIMS

[Claim(s)]
[Claim 1] The multilayer-interconnection ceramic substrate which is a multilayer-interconnection ceramic substrate which consists of a green sheet which has a through hole, and is characterized by filling up with conductive paste from both sides of said green sheet with the 1st screen formed by the pattern of said through hole in said green sheet front face, and the 2nd screen formed by the pattern of said through hole in said green sheet rear face.
[Claim 2] Said 2nd screen is a multilayer-interconnection ceramic substrate according to claim 1 characterized by for 180 degrees having rotated and forming said 1st screen centering on the directional axis of the arbitration on the flat surface.
[Claim 3] It is the manufacture approach of a multilayer-interconnection ceramic substrate including the restoration process which uses a screen for the through hole of the green sheet of a multilayer-interconnection ceramic substrate, and fills up conductive paste with thick film printing. The 1st process which fills up said through hole with a conductor pattern from said green sheet front face using the 1st screen formed by the pattern of said through hole in said green sheet front face, Having formed said restoration process from the 2nd process which fills up said through hole with a conductor pattern from said green sheet rear face using the 2nd screen formed by the pattern of said through hole in said green sheet rear face The manufacture approach of the multilayer-interconnection ceramic substrate by which it is characterized.
[Claim 4] Said 2nd process is the manufacture approach of the multilayer-interconnection ceramic substrate according to claim 3 characterized by filling up said through hole with a conductor pattern using said 2nd screen which rotated 180 degrees and formed said 1st screen centering on the directional axis of the arbitration on the flat surface from the rear face of said green sheet which was made to rotate centering on the directional axis of said arbitration, and was obtained.

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] Especially this invention relates to wiring printing to the green sheet which constitutes a multilayer-interconnection ceramic substrate about a multilayer-interconnection ceramic substrate and its manufacture approach.
[0002]
[Description of the Prior Art] Conventionally, manufacture of the multilayer-interconnection ceramic substrate by the green sheet method is performed in a process as shown in drawing 6 . The organic solvents c, such as a dispersant and a plasticizer, are added to the mixed powder of the fine particles of introduction and Alumina a, and the binder b for compression, and it mixes, and it fully stirs and slurs.
[0003] Here, as a binder b, a cellulose type (methyl cellulose and ethyl cellulose), polyvinyl alcohol, acrylic, a polyvinyl butyral, etc. are mainly used. As a dispersant, a non-ion system surface active agent is used, and dibutyl phthalate, dioctyl phthalate, a glycerol, etc. are used as a plasticizer.
[0004] Although it is in the approach of creating a ceramic green sheet partly, it is based on the doctor blade method suitable for forming a thin sheet here. This doctor blade method is the approach of casting, making dry the above-mentioned slurry with a gap with the film which followed the knife called a doctor blade, and forming a green sheet on a film.
[0005] It is possible to make sheet thickness of a green sheet into for about 0.03-1mm by this approach. In this example, it is referred to as about 0.2mm, and width of face of casting is set to about 160mm. This continuation sheet is cut in the magnitude of about 150mm**, and it considers as a rectangular green sheet (process S11 of drawing 6).
[0006] Next, a through hole hole is formed in a sheet with the combination of a pin and metal mold at the position decided beforehand (process S12 of drawing 6). The aperture of this through hole hole is set to about 250 micrometers, and the pitch of a hole is set to about 2mm. ** [0007] Embedding of conductive paste is performed all over all through holes from the front face of a green sheet by thick film printing after through hole formation (process S13 of drawing 6). A circuit pattern is formed in a green sheet front face for between predetermined through holes next at eye a join pig (process S14 of drawing 6).
[0008] In consideration of the burning temperature of a ceramic, the high tungsten (W) and the molybdenum (Mo) of the melting point are used for the printing paste ingredient used for the embedding of a through hole, and wiring formation. In this case, the wiring width of face and thickness of signal wiring are designed so that it may be set to 200 micrometers and 10 micrometers after baking, respectively.
[0009] Like the above, at a laminating process, the laminating of the ceramic green sheet with which the circuit pattern was printed is carried out so that there may moreover be no gap in predetermined order (process S15 of drawing 6), and thermocompression bonding performs unification formation of two or more sheets further (process S16 of drawing 6), and it is made a raw layered product.
[0010] Debinder baking is performed for this raw layered product at about 1500 degrees C (process S17 of drawing 6), further, by grinding, a form is prepared (process S18 of drawing 6), and a multilayer-interconnection ceramic substrate is formed (process S19 of drawing 6).
[0011] In case a multilayer-interconnection ceramic substrate is manufactured in the above-mentioned process, embedding of the conductive paste to the through hole of a green sheet is usually performed by the thick film screen

printing which used one kind of screen.
[0012]
[Problem(s) to be Solved by the Invention] Since the thick film screen printing which used one kind of screen is performing embedding of the conductive paste to a through hole, in order to secure flow dependability in the embedding of the conductive paste to the inside of a through hole, it is necessary to fill up sufficient quantity of conductive paste with the manufacture approach of the conventional multilayer-interconnection ceramic substrate mentioned above.
[0013] If the ratio of the thickness of a sheet and the diameter of a through hole, i.e., an aspect ratio, generally becomes large by the densification of wiring, it will be hard coming to fill up the conductive paste of sufficient amount for a through hole with the above-mentioned thick film printing.
[0014] In recent years, in connection with the densification of wiring, the diameter of a through hole is made detailed more, and is in the inclination for an aspect ratio to increase by this.
[0015] In the manufacture process of the multilayer-interconnection ceramic substrate mentioned above, even if conductive paste 10b of sufficient amount is not filled up with one printing to through hole 10a of a green sheet 10, but it carries out a laminating to other green sheets 8 and it forms the raw layered product 11 as shown in drawing 7 in case conductive paste is filled up into a through hole with thick film screen printing, a flow with through hole 10a and circuit pattern 8a may be unable to be taken.
[0016] For this reason, the open circuit is prevented by repeating printing 2 times or more than it, and performing it. However, in this repetition printing, conductive paste adheres to a through hole periphery, who and a blot are produced, and it is easy to produce a short circuit with a contiguity conductor pattern.
[0017] Then, it is in the object of this invention offering the multilayer-interconnection ceramic substrate which can embed sufficient quantity of conductive paste in a through hole, and can raise the flow dependability of a through hole, and its manufacture approach, without canceling the above-mentioned trouble and performing repetition printing from the same side.
[0018]
[Means for Solving the Problem] The multilayer-interconnection ceramic substrate by this invention is a multilayer-interconnection ceramic substrate which consists of a green sheet which has a through hole, and it fills up with conductive paste from both sides of said green sheet with the 1st screen formed by the pattern of said through hole in said green sheet front face, and the 2nd screen formed by the pattern of said through hole in said green sheet rear face.
[0019] The manufacture approach of the multilayer-interconnection ceramic substrate by this invention It is the manufacture approach of a multilayer-interconnection ceramic substrate including the restoration process which uses a screen for the through hole of the green sheet of a multilayer-interconnection ceramic substrate, and fills up conductive paste with thick film printing. The 1st process which fills up said through hole with a conductor pattern from said green sheet front face using the 1st screen formed by the pattern of said through hole in said green sheet front face, Said restoration process is formed from the 2nd process which fills up said through hole with a conductor pattern from said green sheet rear face using the 2nd screen formed by the pattern of said through hole in said green sheet rear face.
[0020]
[Function] In the embedding process of the conductive paste to the through hole of a green sheet, embedding of conductive paste is usually performed all over all through holes from the front face of a green sheet using the screen of a pattern.
[0021] Next, embedding of conductive paste is performed all over all through holes from the rear face of a green sheet using the reversal screen which rotated 180 degrees and usually formed the pattern centering on the directional axis of the arbitration on the flat surface.
[0022] By this, without performing repetition printing from the same field, even when an aspect ratio is large, it becomes possible to embed the conductive paste of sufficient amount for a through hole, and improvement in the flow dependability of a through hole can be aimed at.
[0023]
[Example] Next, one example of this invention is explained with reference to a drawing.
[0024] Drawing 1 is drawing showing the manufacture process of the one example **** multilayer-interconnection ceramic substrate of this invention. In drawing, except that the processes to which one example of this invention performs embedding of conductive paste to a through hole differ, a multilayer-interconnection ceramic substrate is

manufactured at the same process as the conventional example shown in drawing 6 .
[0025] here -- drawing 1 and drawing 6 -- setting -- a process S1 -- a process S11 -- a process S2 -- a process S12 -- a process S5 -- a process S14 -- a process S6 -- a process S15 -- a process S7 -- a process S16 -- process S9 is equivalent to a process S18, and the process S10 is equivalent to the process S17 for the process S8 at the process S19, respectively.
[0026] After forming a through hole in a green sheet, embedding of conductive paste is performed by thick film printing to all these through holes. In this process, if the ratio of the thickness of a sheet and the diameter of a through hole, i.e., an aspect ratio, becomes large, the embedding of sufficient quantity of conductive paste will become difficult. Although it changes with various conditions by the usual thick-film-screen-printing approach, when an aspect ratio becomes two to three or more, sufficient quantity of especially paste embedding is difficult.
[0027] one example of this invention -- the conductor to this through hole -- in an embedding process with a pace, embedding of conductive paste is usually first performed all over all through holes from the front face of a green sheet using the screen of a pattern (process S3 of drawing 1).
[0028] Next, embedding of conductive paste is performed all over all through holes from the rear face of a green sheet using the reversal screen which usually carried out right-and-left reversal of the pattern, i.e., the screen which rotated 180 degrees and usually formed the pattern centering on the directional axis of the arbitration on the flat surface, (process S4 of drawing 1). By this, an aspect ratio can perform paste embedding of sufficient amount also for the through hole of 4-5.
[0029] Drawing 2 is drawing showing the example of embedding of the conductive paste to the inside of the through hole from the front face of the green sheet by one example of this invention, and drawing 3 and drawing 4 are drawings showing the example of embedding of the conductive paste to the inside of the through hole from the rear face of the green sheet by one example of this invention.
[0030] Drawing 3 shows signs that conductive paste (not shown) is embedded from the rear face of a green sheet (not shown) in all through holes using the reversal screen 5 which was rotated 180 degrees focusing on the Y-axis, and formed the screen 1 of drawing 2 .
[0031] Moreover, drawing 4 shows signs that conductive paste is embedded from the rear face of a green sheet in all through holes using the reversal screen 6 which was rotated 180 degrees focusing on the X-axis, and formed the screen 1 of drawing 2 .
[0032] In addition, when performing embedding of conductive paste from the rear face of a green sheet using the reversal screens 5 and 6, the location of a through hole and the hole for through hole embedding of the reversal screens 5 and 6 in the rear face of a green sheet suit by rotating 180 degrees of green sheets centering on the revolving shaft (for example, the X-axis and a Y-axis) of the reversal screen 5 and the screen 1 at the time of 6 formation, when turning the rear face of a green sheet up and holding in the metal frame 4. Moreover, three on a screen 1 and the reversal screen 5, and 6 shows the orientation mark which shows the criteria at the time of printing.
[0033] Drawing 5 is drawing showing restoration of the conductive paste to the through hole of the green sheet by one example of this invention. In drawing, while filling up with conductive paste 7b from a front face to through hole 7a of a green sheet 7, it fills up with conductive paste 7c from the rear face.
[0034] Therefore, since it fills up with sufficient quantity of conductive paste 7b and 7c to through hole 7a of a green sheet 7, when carrying out a laminating to other green sheets 8 and forming the raw layered product 9, a flow with through hole 7a and circuit pattern 8a can be taken.
[0035] Thus, without performing repetition printing from the same field to the green sheet in which an aspect ratio has a big through hole by being filled up with conductive paste 7c using the reversal screens 5 and 6 from the rear face of a green sheet 7, while being filled up with conductive paste 7b using a screen 1 from the front face of the green sheet 7 which has through hole 7a, sufficient quantity of conductive paste can be embedded in a through hole, and the flow dependability of a through hole can be raised.
[0036]
[Effect of the Invention] In the multilayer-interconnection ceramic substrate which contains the green sheet which has a through hole according to this invention as explained above By being filled up with conductive paste from green sheet both sides with the 1st screen formed by the pattern of the through hole in a green sheet front face, and the 2nd screen formed by the pattern of the through hole in a green sheet rear face Without performing repetition printing from the same side, sufficient quantity of conductive paste can be embedded in a through hole, and it is effective in the ability to

raise the flow dependability of a through hole.

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TECHNICAL FIELD

[Industrial Application] Especially this invention relates to wiring printing to the green sheet which constitutes a multilayer-interconnection ceramic substrate about a multilayer-interconnection ceramic substrate and its manufacture approach.

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PRIOR ART

[Description of the Prior Art] Conventionally, manufacture of the multilayer-interconnection ceramic substrate by the green sheet method is performed in a process as shown in drawing 6 . The organic solvents c, such as a dispersant and a plasticizer, are added to the mixed powder of the fine particles of introduction and Alumina a, and the binder b for compression, and it mixes, and it fully stirs and slurs.
[0003] Here, as a binder b, a cellulose type (methyl cellulose and ethyl cellulose), polyvinyl alcohol, acrylic, a polyvinyl butyral, etc. are mainly used. As a dispersant, a non-ion system surface active agent is used, and dibutyl phthalate, dioctyl phthalate, a glycerol, etc. are used as a plasticizer.
[0004] Although it is in the approach of creating a ceramic green sheet partly, it is based on the doctor blade method suitable for forming a thin sheet here. This doctor blade method is the approach of casting, making dry the above-mentioned slurry with a gap with the film which followed the knife called a doctor blade, and forming a green sheet on a film.
[0005] It is possible to make sheet thickness of a green sheet into for about 0.03-1mm by this approach. In this example, it is referred to as about 0.2mm, and width of face of casting is set to about 160mm. This continuation sheet is cut in the magnitude of about 150mm**, and it considers as a rectangular green sheet (process S11 of drawing 6).
[0006] Next, a through hole hole is formed in a sheet with the combination of a pin and metal mold at the position decided beforehand (process S12 of drawing 6). The aperture of this through hole hole is set to about 250 micrometers, and the pitch of a hole is set to about 2mm. ** [0007] Embedding of conductive paste is performed all over all through holes from the front face of a green sheet by thick film printing after through hole formation (process S13 of drawing 6). A circuit pattern is formed in a green sheet front face for between predetermined through holes next at eye a join pig (process S14 of drawing 6).
[0008] In consideration of the burning temperature of a ceramic, the high tungsten (W) and the molybdenum (Mo) of the melting point are used for the printing paste ingredient used for the embedding of a through hole, and wiring formation. In this case, the wiring width of face and thickness of signal wiring are designed so that it may be set to 200 micrometers and 10 micrometers after baking, respectively.
[0009] Like the above, at a laminating process, the laminating of the ceramic green sheet with which the circuit pattern was printed is carried out so that there may moreover be no gap in predetermined order (process S15 of drawing 6), and thermocompression bonding performs unification formation of two or more sheets further (process S16 of drawing 6), and it is made a raw layered product.
[0010] Debinder baking is performed for this raw layered product at about 1500 degrees C (process S17 of drawing 6), further, by grinding, a form is prepared (process S18 of drawing 6), and a multilayer-interconnection ceramic substrate is formed (process S19 of drawing 6).
[0011] In case a multilayer-interconnection ceramic substrate is manufactured in the above-mentioned process, embedding of the conductive paste to the through hole of a green sheet is usually performed by the thick film screen printing which used one kind of screen.

[Translation done.]

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EFFECT OF THE INVENTION

[Effect of the Invention] The 1st screen formed by the pattern of the through hole in a green sheet front face in the multilayer-interconnection ceramic substrate containing the green sheet which has a through hole according to [as explained above] this invention, and the 2nd screen formed by the pattern of the through hole in a green sheet rear face Without performing repetition printing from the same side by being filled up with conductive paste from green sheet both sides, sufficient quantity of conductive paste can be embedded in a through hole, and it is effective in the ability to raise the flow dependability of a through hole.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] Since the thick film screen printing which used one kind of screen is performing embedding of the conductive paste to a through hole, in order to secure flow dependability in the embedding of the conductive paste to the inside of a through hole, it is necessary to fill up sufficient quantity of conductive paste with the manufacture approach of the conventional multilayer-interconnection ceramic substrate mentioned above.

[0013] If the ratio of the thickness of a sheet and the diameter of a through hole, i.e., an aspect ratio, generally becomes large by the densification of wiring, it will be hard coming to fill up the conductive paste of sufficient amount for a through hole with the above-mentioned thick film printing.

[0014] In recent years, in connection with the densification of wiring, the diameter of a through hole is made detailed more, and is in the inclination for an aspect ratio to increase by this.

[0015] In the manufacture process of the multilayer-interconnection ceramic substrate mentioned above, even if conductive paste 10b of sufficient amount is not filled up with one printing to through hole 10a of a green sheet 10, but it carries out a laminating to other green sheets 8 and it forms the raw layered product 11 as shown in drawing 7 in case conductive paste is filled up into a through hole with thick film screen printing, a flow with through hole 10a and circuit pattern 8a may be unable to be taken.

[0016] For this reason, the open circuit is prevented by repeating printing 2 times or more than it, and performing it. However, in this repetition printing, conductive paste adheres to a through hole periphery, who and a blot are produced, and it is easy to produce a short circuit with a contiguity conductor pattern.

[0017] Then, it is in the object of this invention offering the multilayer-interconnection ceramic substrate which can embed sufficient quantity of conductive paste in a through hole, and can raise the flow dependability of a through hole, and its manufacture approach, without canceling the above-mentioned trouble and performing repetition printing from the same side.

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MEANS

[Means for Solving the Problem] The multilayer-interconnection ceramic substrate by this invention is a multilayer-interconnection ceramic substrate which consists of a green sheet which has a through hole, and it fills up with conductive paste from both sides of said green sheet with the 1st screen formed by the pattern of said through hole in said green sheet front face, and the 2nd screen formed by the pattern of said through hole in said green sheet rear face. [0019] The manufacture approach of the multilayer-interconnection ceramic substrate by this invention It is the manufacture approach of a multilayer-interconnection ceramic substrate including the restoration process which uses a screen for the through hole of the green sheet of a multilayer-interconnection ceramic substrate, and fills up conductive paste with thick film printing. The 1st process which fills up said through hole with a conductor pattern from said green sheet front face using the 1st screen formed by the pattern of said through hole in said green sheet front face, Said restoration process is formed from the 2nd process which fills up said through hole with a conductor pattern from said green sheet rear face using the 2nd screen formed by the pattern of said through hole in said green sheet rear face.

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OPERATION

[Function] In the embedding process of the conductive paste to the through hole of a green sheet, embedding of conductive paste is usually performed all over all through holes from the front face of a green sheet using the screen of a pattern.
[0021] Next, embedding of conductive paste is performed all over all through holes from the rear face of a green sheet using the reversal screen which rotated 180 degrees and usually formed the pattern centering on the directional axis of the arbitration on the flat surface.
[0022] By this, without performing repetition printing from the same field, even when an aspect ratio is large, it becomes possible to embed the conductive paste of sufficient amount for a through hole, and improvement in the flow dependability of a through hole can be aimed at.

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EXAMPLE

[Example] Next, one example of this invention is explained with reference to a drawing.
[0024] Drawing 1 is drawing showing the manufacture process of the one example **** multilayer-interconnection ceramic substrate of this invention. In drawing, except that the processes to which one example of this invention performs embedding of conductive paste to a through hole differ, a multilayer-interconnection ceramic substrate is manufactured at the same process as the conventional example shown in drawing 6 .
[0025] here -- drawing 1 and drawing 6 -- setting -- a process S1 -- a process S11 -- a process S2 -- a process S12 -- a process S5 -- a process S14 -- a process S6 -- a process S15 -- a process S7 -- a process S16 -- process S9 is equivalent to a process S18, and the process S10 is equivalent to the process S17 for the process S8 at the process S19, respectively.
[0026] After forming a through hole in a green sheet, embedding of conductive paste is performed by thick film printing to all these through holes. In this process, if the ratio of the thickness of a sheet and the diameter of a through hole, i.e., an aspect ratio, becomes large, the embedding of sufficient quantity of conductive paste will become difficult. Although it changes with various conditions by the usual thick-film-screen-printing approach, when an aspect ratio becomes two to three or more, sufficient quantity of especially paste embedding is difficult.
[0027] one example of this invention -- the conductor to this through hole -- in an embedding process with a pace, embedding of conductive paste is usually first performed all over all through holes from the front face of a green sheet using the screen of a pattern (process S3 of drawing 1).
[0028] Next, embedding of conductive paste is performed all over all through holes from the rear face of a green sheet using the reversal screen which usually carried out right-and-left reversal of the pattern, i.e., the screen which rotated 180 degrees and usually formed the pattern centering on the directional axis of the arbitration on the flat surface, (process S4 of drawing 1). By this, an aspect ratio can perform paste embedding of sufficient amount also for the through hole of 4-5.
[0029] Drawing 2 is drawing showing the example of embedding of the conductive paste to the inside of the through hole from the front face of the green sheet by one example of this invention, and drawing 3 and drawing 4 are drawings showing the example of embedding of the conductive paste to the inside of the through hole from the rear face of the green sheet by one example of this invention.
[0030] Drawing 3 shows signs that conductive paste (not shown) is embedded from the rear face of a green sheet (not shown) in all through holes using the reversal screen 5 which was rotated 180 degrees focusing on the Y-axis, and formed the screen 1 of drawing 2 .
[0031] Moreover, drawing 4 shows signs that conductive paste is embedded from the rear face of a green sheet in all through holes using the reversal screen 6 which was rotated 180 degrees focusing on the X-axis, and formed the screen 1 of drawing 2 .
[0032] In addition, when performing embedding of conductive paste from the rear face of a green sheet using the reversal screens 5 and 6, the location of a through hole and the hole for through hole embedding of the reversal screens 5 and 6 in the rear face of a green sheet suit by rotating 180 degrees of green sheets centering on the revolving shaft (for example, the X-axis and a Y-axis) of the reversal screen 5 and the screen 1 at the time of 6 formation, when turning the rear face of a green sheet up and holding in the metal frame 4. Moreover, three on a screen 1 and the reversal screen 5, and 6 shows the orientation mark which shows the criteria at the time of printing.
[0033] Drawing 5 is drawing showing restoration of the conductive paste to the through hole of the green sheet by one

example of this invention. In drawing, while filling up with conductive paste 7b from a front face to through hole 7a of a green sheet 7, it fills up with conductive paste 7c from the rear face.
[0034] Therefore, since it fills up with sufficient quantity of conductive paste 7b and 7c to through hole 7a of a green sheet 7, when carrying out a laminating to other green sheets 8 and forming the raw layered product 9, a flow with through hole 7a and circuit pattern 8a can be taken.
[0035] Thus, without performing repetition printing from the same field to the green sheet in which an aspect ratio has a big through hole by being filled up with conductive paste 7c using the reversal screens 5 and 6 from the rear face of a green sheet 7, while being filled up with conductive paste 7b using a screen 1 from the front face of the green sheet 7 which has through hole 7a, sufficient quantity of conductive paste can be embedded in a through hole, and the flow dependability of a through hole can be raised.
[0036]

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is drawing showing the manufacture process of the multilayer-interconnection ceramic substrate by one example of this invention.
[Drawing 2] It is drawing showing the example of embedding of the conductive paste to the inside of the through hole from the front face of the green sheet by one example of this invention.
[Drawing 3] It is drawing showing the example of embedding of the conductive paste to the inside of the through hole from the rear face of the green sheet by one example of this invention.
[Drawing 4] It is drawing showing the example of embedding of the conductive paste to the inside of the through hole from the rear face of the green sheet by one example of this invention.
[Drawing 5] It is drawing showing restoration of the conductive paste to the through hole of the green sheet by one example of this invention.
[Drawing 6] It is drawing showing the manufacture process of the conventional multilayer-interconnection ceramic substrate.
[Drawing 7] It is drawing showing restoration of the conductive paste to the through hole of the green sheet by the conventional example.
[Description of Notations]
1 Screen
2 Hole for through Hole Embedding
4 Metal Frame
5 Six Reversal screen
7 Eight Green sheet
7a Through hole
7a, 7c Conductive paste
8a Circuit pattern

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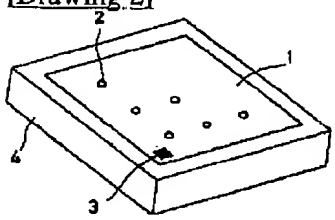
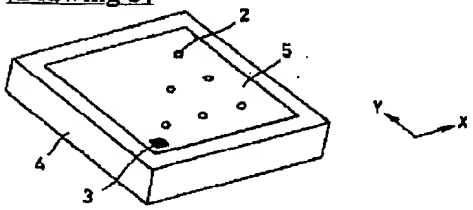
DRAWINGS

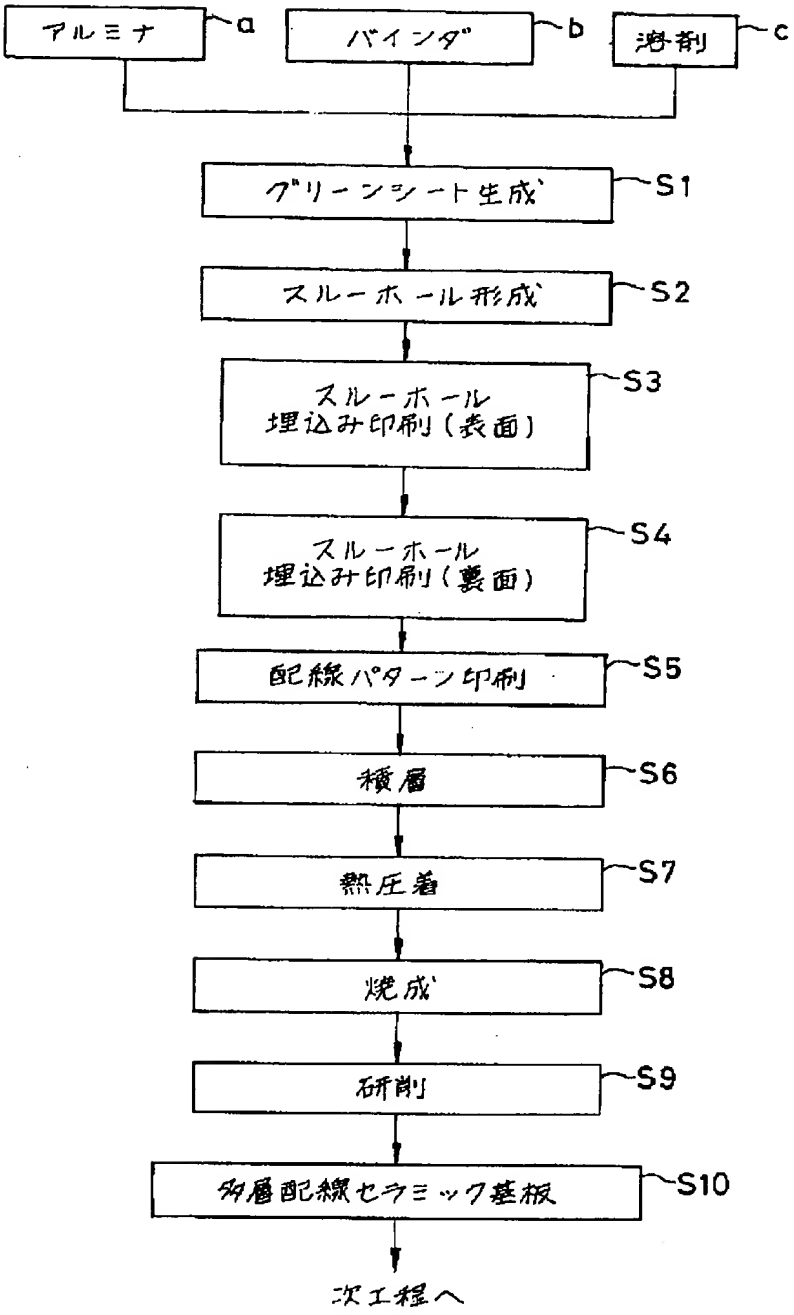
[Drawing 2]



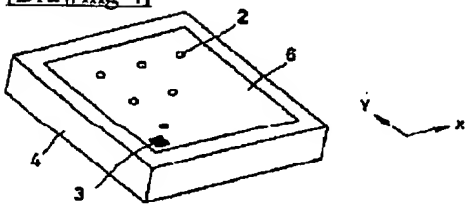
[Drawing 3]



[Drawing 1]



[Drawing 4]



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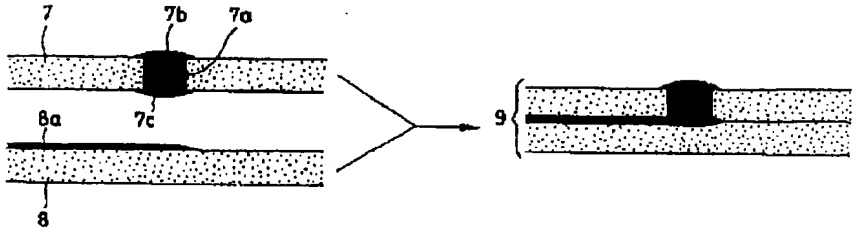

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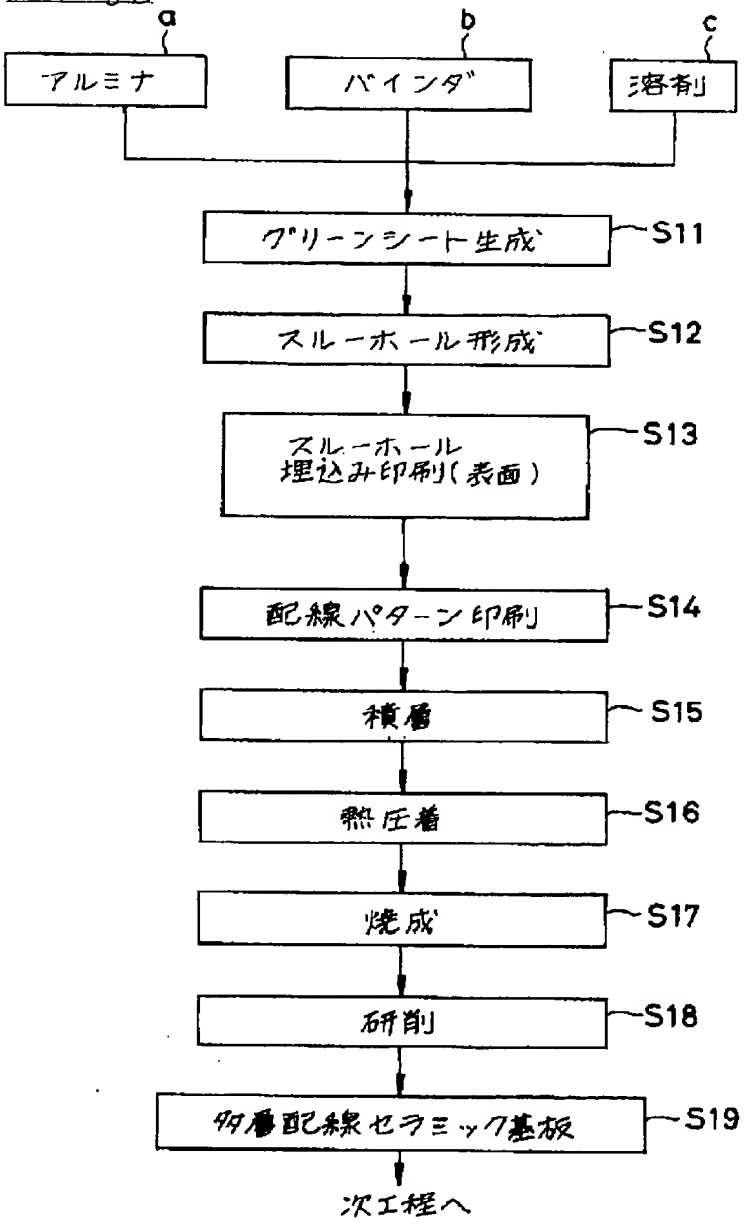

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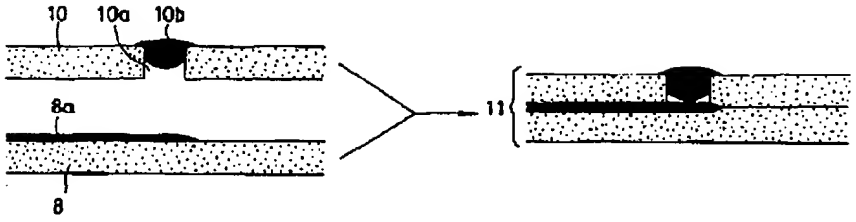

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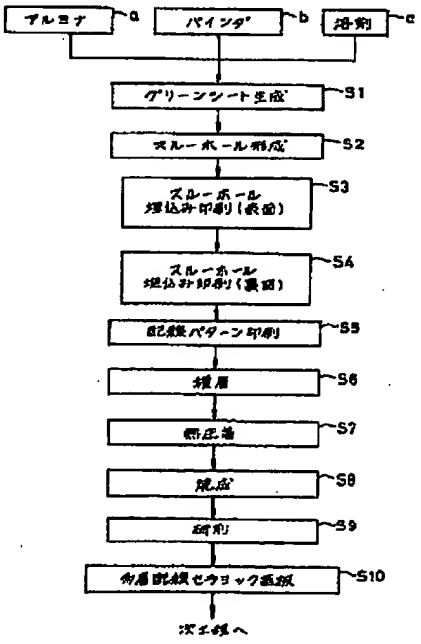
(54)【発明の名称】　多層配線セラミック基板及びその製造方法

(57)【要約】

【目的】　繰返し印刷を行うことなく、十分な量の導体ペーストのスルーホールへの埋め込みを可能とし、スルーホールの導通信頼性の向上を図る。

【構成】　多層配線セラミック基板を製造するプロセスにおいて、工程Ｓ３で、通常パターンのスクリーンを用いてグリーンシートの表面から全てのスルーホール中に導体ペーストの埋め込みを行う。その後に、工程Ｓ４で、通常パターンを左右反転した反転スクリーンを用いてグリーンシートの裏面から全てのスルーホール中に導体ペーストの埋め込みを行う。



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【特許請求の範囲】

【請求項１】 スルーホールを有するグリーンシートからなる多層配線セラミック基板であって、前記グリーンシート表面における前記スルーホールのパターンで形成された第１のスクリーンと前記グリーンシート裏面における前記スルーホールのパターンで形成された第２のスクリーンとによって前記グリーンシートの両面から導体ペーストが充填されたことを特徴とする多層配線セラミック基板。

【請求項２】 前記第２のスクリーンは、前記第１のスクリーンをその平面上の任意の方向軸を中心に１８０°回転して形成したことを特徴とする請求項１記載の多層配線セラミック基板。

【請求項３】 多層配線セラミック基板のグリーンシートのスルーホールにスクリーンを用いて厚膜印刷法で導体ペーストを充填する充填工程を含む多層配線セラミック基板の製造方法であって、前記グリーンシート表面における前記スルーホールのパターンで形成された第１のスクリーンを用いて前記グリーンシート表面から前記スルーホールに導体パターンを充填する第１の工程と、前記グリーンシート裏面における前記スルーホールのパターンで形成された第２のスクリーンを用いて前記グリーンシート裏面から前記スルーホールに導体パターンを充填する第２の工程とから前記充填工程を形成したことを特徴とする多層配線セラミック基板の製造方法。

【請求項４】 前記第２の工程は、前記第１のスクリーンをその平面上の任意の方向軸を中心に１８０° 回転して形成した前記第２のスクリーンを用いて、前記任意の方向軸を中心に回転させて得た前記グリーンシートの裏面から前記スルーホールに導体パターンを充填するようにしたことを特徴とする請求項３記載の多層配線セラミック基板の製造方法。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】本発明は多層配線セラミック基板及びその製造方法に関し、特に多層配線セラミック基板を構成するグリーンシートへの配線印刷に関する。

【０００２】

【従来の技術】従来、グリーンシート法による多層配線セラミック基板の製造は、図６に示すようなプロセスで行われる。初めに、アルミナａの粉体と固形化のためのバインダｂとの混合粉に分散剤や可塑剤等の有機溶剤ｃとを加えて混合し、十分に撹拌してスラリー化する。

【０００３】ここで、バインダｂとしてはセルロース系（メチルセルロースやエチルセルロース）、ポリビニルアルコール、アクリル系、ポリビニルブチラール等が主に用いられる。分散剤としては非イオン系界面活性剤が、可塑剤としてはジブチルフタレート、ジオクチルフタレート、グリセリン等が用いられる。

【０００４】セラミックグリーンシートを作成する方法

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にはいくつかあるが、ここでは薄いシートを形成するのに適しているドクターブレード法によっている。このドクターブレード法は上記のスラリーをドクターブレードと呼ばれるナイフと連続したフィルムとのギャップによってキャスティングを行い、乾燥させてフィルム上にグリーンシートを形成する方法である。

【０００５】この方法ではグリーンシートのシート厚を約０．０３～１ｍｍの間とすることが可能である。本例では約０．２ｍｍとし、キャスティングの幅を約１６０ｍｍとしている。この連続シートを約１５０ｍｍ□の大きさに切り、方形のグリーンシートとする（図６の工程Ｓ１１）。

【０００６】次に、シートにスルーホール孔をピンと金型との組合せによって、予め決められた所定の位置に形成する（図６の工程Ｓ１２）。このスルーホール孔の孔径を約２５０μｍとし、孔のピッチを約２ｍｍとする。ぬ

【０００７】スルーホール形成の後、厚膜印刷法でグリーンシートの表面から全てのスルーホール中に導体ペーストの埋め込みを行う（図６の工程Ｓ１３）。この後に、所定のスルーホール間を結ぶために、グリーンシート表面に配線パターンを形成する（図６の工程Ｓ１４）。

【０００８】スルーホールの埋め込み及び配線形成に用いる印刷ペースト材料にはセラミックの焼成温度を考慮し、融点の高いタングステン（Ｗ）やモリブデン（Ｍｏ）が用いられる。この場合、信号配線の配線幅及び膜厚は焼成後夫々２００μｍ、１０μｍとなるように設計されている。

【０００９】上記の如く、配線パターンが印刷されたセラミックグリーンシートを積層工程にて所定の順に、しかもずれがないように積層し（図６の工程Ｓ１５）、さらに熱圧着により複数のシートの一体化形成を行い（図６の工程Ｓ１６）、生積層体にする。

【００１０】この生積層体を１５００℃程度で脱バインダ焼成を行い（図６の工程Ｓ１７）、さらに研削によって形を整え（図６の工程Ｓ１８）、多層配線セラミック基板を形成する（図６の工程Ｓ１９）。

【００１１】上記のプロセスで多層配線セラミック基板を製造する際に、通常、グリーンシートのスルーホールへの導体ペーストの埋め込みは１種類のスクリーンを用いた厚膜印刷によって行われている。

【００１２】

【発明が解決しようとする課題】上述した従来の多層配線セラミック基板の製造方法では、スルーホールへの導体ペーストの埋め込みを１種類のスクリーンを用いた厚膜印刷によって行っているので、スルーホール中への導体ペーストの埋め込みにおいて導通信頼性を確保するために十分な量の導体ペーストを充填する必要がある。

【００１３】上記の厚膜印刷法では、一般にシートの厚

みとスルーホール径との比、すなわちアスペクト比が配線の高密度化によって大きくなると、スルーホールに十分な量の導体ペーストが充填しにくくなる。

【００１４】近年、配線の高密度化にともなってスルーホール径はより微細化し、これによってアスペクト比が増大する傾向にある。

【００１５】上述した多層配線セラミック基板の製造プロセスでは、スルーホールに導体ペーストを厚膜印刷で充填する際、図７に示すように、一回の印刷ではグリーンシート１０のスルーホール１０ａに対して十分な量の導体ペースト１０ｂが充填されず、他のグリーンシート８に積層して生積層体１１を形成しても、スルーホール１０ａと配線パターン８ａとの導通がとれないことがある。

【００１６】このため、印刷を２回またはそれ以上繰返し行うことで断線を防いでいる。しかしながら、この繰返し印刷ではスルーホール周辺部に導体ペーストが付着してだれやにじみを生じ、隣接導体パターンとの短絡が生じやすい。

【００１７】そこで、本発明の目的は上記の問題点を解消し、同一面からの繰返し印刷を行うことなく、十分な量の導体ペーストをスルーホールに埋め込むことができ、スルーホールの導通信頼性を向上させることができる多層配線セラミック基板及びその製造方法を提供することにある。

【００１８】

【課題を解決するための手段】本発明による多層配線セラミック基板は、スルーホールを有するグリーンシートからなる多層配線セラミック基板であって、前記グリーンシート表面における前記スルーホールのパターンで形成された第１のスクリーンと前記グリーンシート裏面における前記スルーホールのパターンで形成された第２のスクリーンとによって前記グリーンシートの両面から導体ペーストが充填されている。

【００１９】本発明による多層配線セラミック基板の製造方法は、多層配線セラミック基板のグリーンシートのスルーホールにスクリーンを用いて厚膜印刷法で導体ペーストを充填する充填工程を含む多層配線セラミック基板の製造方法であって、前記グリーンシート表面における前記スルーホールのパターンで形成された第１のスクリーンを用いて前記グリーンシート表面から前記スルーホールに導体パターンを充填する第１の工程と、前記グリーンシート裏面における前記スルーホールのパターンで形成された第２のスクリーンを用いて前記グリーンシート裏面から前記スルーホールに導体パターンを充填する第２の工程とから前記充填工程を形成している。

【００２０】

【作用】グリーンシートのスルーホールへの導体ペーストの埋め込み工程において、通常パターンのスクリーンを用いてグリーンシートの表面から全てのスルーホール中に導体ペーストの埋め込みを行う。

【００２１】次に、通常パターンをその平面上の任意の方向軸を中心に１８０°回転して形成した反転スクリーンを用いてグリーンシートの裏面から全てのスルーホール中に導体ペーストの埋め込みを行う。

【００２２】これによって、アスペクト比が大きい場合でも、同一面からの繰返し印刷を行うことなく、スルーホールに十分な量の導体ペーストを埋め込むことが可能となり、スルーホールの導通信頼性の向上が図れる。

【００２３】

【実施例】次に、本発明の一実施例について図面を参照して説明する。

【００２４】図１は本発明の一実施例よる多層配線セラミック基板の製造プロセスを示す図である。図において、本発明の一実施例はスルーホールに導体ペーストの埋め込みを行う工程が異なる以外は図６に示す従来例と同様の工程で多層配線セラミック基板が製造される。

【００２５】ここで、図１と図６とにおいては、工程Ｓ１が工程Ｓ１１に、工程Ｓ２が工程Ｓ１２に、工程Ｓ５が工程Ｓ１４に、工程Ｓ６が工程Ｓ１５に、工程Ｓ７が工程Ｓ１６に、工程Ｓ８が工程Ｓ１７に、工程Ｓ９が工程Ｓ１８に、工程Ｓ１０が工程Ｓ１９に夫々対応している。

【００２６】グリーンシートにスルーホールを形成した後に、それらスルーホール全てに対して厚膜印刷法で導体ペーストの埋め込みを行う。この工程において、シートの厚みとスルーホール径との比、すなわちアスペクト比が大きくなると、十分な量の導体ペーストの埋め込みが困難になる。通常の厚膜印刷方法では各種条件によって異なるが、アスペクト比が２～３以上になると、十分な量のペースト埋め込みは特に難しい。

【００２７】本発明の一実施例では、このスルーホールへの導体ペーストとの埋め込み工程において、まず通常パターンのスクリーンを用いてグリーンシートの表面から全てのスルーホール中に導体ペーストの埋め込みを行う（図１の工程Ｓ３）。

【００２８】次に、通常パターンを左右反転した反転スクリーン、つまり通常パターンをその平面上の任意の方向軸を中心に１８０°回転して形成したスクリーンを用いてグリーンシートの裏面から全てのスルーホール中に導体ペーストの埋め込みを行う（図１の工程Ｓ４）。これによって、アスペクト比が４～５のスルーホールにも十分な量のペースト埋め込みを行うことができる。

【００２９】図２は本発明の一実施例によるグリーンシートの表面からのスルーホール中への導体ペーストの埋め込み例を示す図であり、図３及び図４は本発明の一実施例によるグリーンシートの裏面からのスルーホール中への導体ペーストの埋め込み例を示す図である。

【００３０】図３は図２のスクリーン１をＹ軸を中心に１８０°回転させて形成した反転スクリーン５を用いて

グリーンシート（図示せず）の裏面から全てのスルーホールに導体ペースト（図示せず）を埋め込む様子を示している。

【００３１】また、図４は図２のスクリーン１をＸ軸を中心に１８０° 回転させて形成した反転スクリーン６を用いてグリーンシートの裏面から全てのスルーホールに導体ペーストを埋め込む様子を示している。

【００３２】尚、反転スクリーン５，６を用いてグリーンシートの裏面から導体ペーストの埋め込みを行う場合、グリーンシートの裏面を上にして金属枠４に保持するときにグリーンシートを反転スクリーン５，６形成時のスクリーン１の回転軸（例えば、Ｘ軸やＹ軸）を中心にして１８０° 回転させることで、グリーンシートの裏面におけるスルーホールの位置と反転スクリーン５，６のスルーホール埋め込み用穴とが合うようになっている。また、スクリーン１及び反転スクリーン５，６上の３は印刷時の基準を示すオリエンテーションマークを示している。

【００３３】図５は本発明の一実施例によるグリーンシートのスルーホールへの導体ペーストの充填を示す図である。図において、グリーンシート７のスルーホール７ａに対しては表面から導体ペースト７ｂが充填されるとともに、裏面から導体ペースト７ｃが充填されている。

【００３４】したがって、グリーンシート７のスルーホール７ａに対して十分な量の導体ペースト７ｂ，７ｃが充填されるので、他のグリーンシート８に積層して生積層体９を形成するときにスルーホール７ａと配線パターン８ａとの導通をとることができる。

【００３５】このように、スルーホール７ａを有するグリーンシート７の表面からスクリーン１を用いて導体ペースト７ｂを充填するとともに、グリーンシート７の裏面から反転スクリーン５，６を用いて導体ペースト７ｃを充填することによって、アスペクト比が大きなスルーホールを持つグリーンシートに同一面からの繰返し印刷を行うことなく、十分な量の導体ペーストをスルーホールに埋め込むことができ、スルーホールの導通信頼性を向上させることができる。

【００３６】

＊【発明の効果】以上説明したように本発明によれば、スルーホールを有するグリーンシートを含む多層配線セラミック基板において、グリーンシート表面におけるスルーホールのパターンで形成された第１のスクリーンとグリーンシート裏面におけるスルーホールのパターンで形成された第２のスクリーンとによってグリーンシート両面から導体ペーストを充填することによって、同一面からの繰返し印刷を行うことなく、十分な量の導体ペーストをスルーホールに埋め込むことができ、スルーホールの導通信頼性を向上させることができるという効果がある。

【図面の簡単な説明】

【図１】本発明の一実施例による多層配線セラミック基板の製造プロセスを示す図である。

【図２】本発明の一実施例によるグリーンシートの表面からのスルーホール中への導体ペーストの埋め込み例を示す図である。

【図３】本発明の一実施例によるグリーンシートの裏面からのスルーホール中への導体ペーストの埋め込み例を示す図である。

【図４】本発明の一実施例によるグリーンシートの裏面からのスルーホール中への導体ペーストの埋め込み例を示す図である。

【図５】本発明の一実施例によるグリーンシートのスルーホールへの導体ペーストの充填を示す図である。

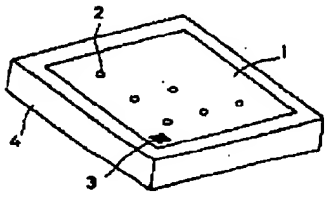
【図６】従来の多層配線セラミック基板の製造プロセスを示す図である。

【図７】従来例によるグリーンシートのスルーホールへの導体ペーストの充填を示す図である。

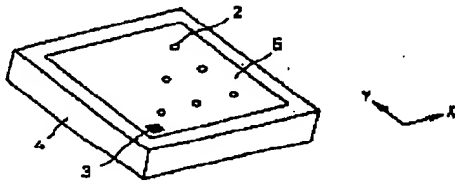
【符号の説明】

１　スクリーン
２　スルーホール埋め込み用穴
４　金属枠
５，６　反転スクリーン
７，８　グリーンシート
７ａ　スルーホール
７ａ，７ｃ　導体ペースト
８ａ　配線パターン

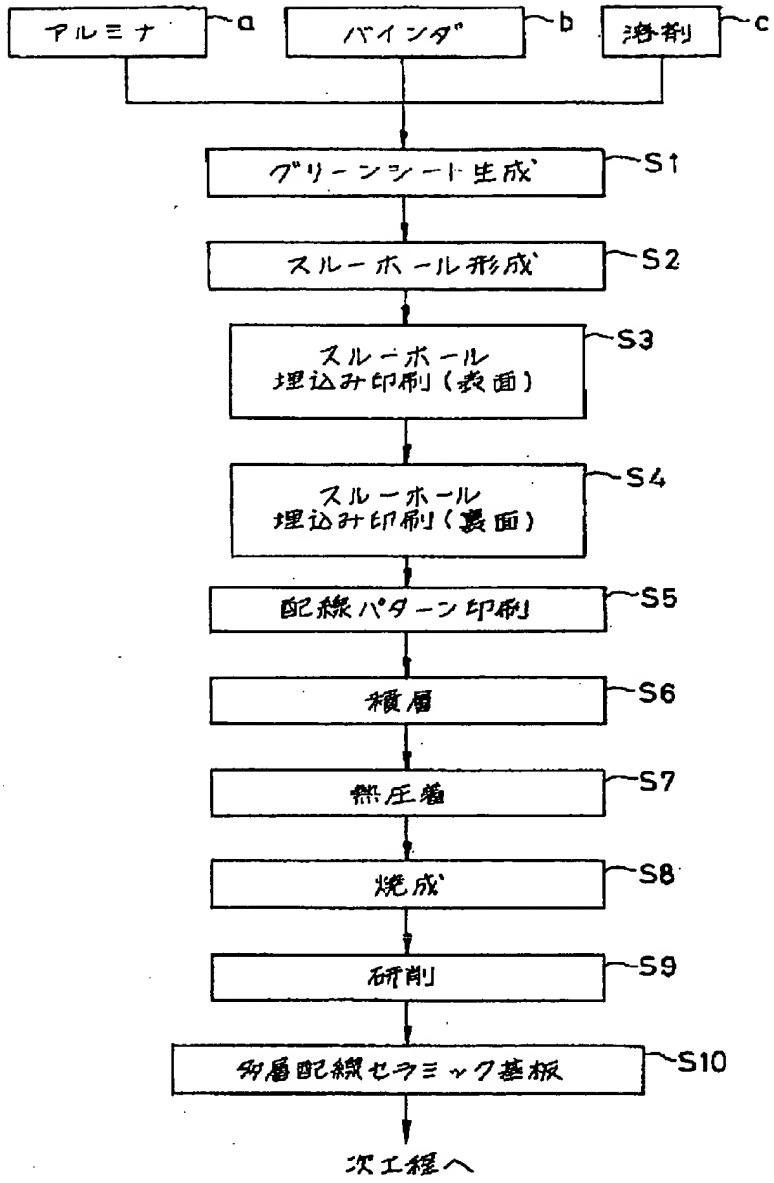
【図２】



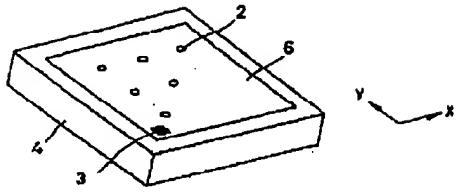
【図３】



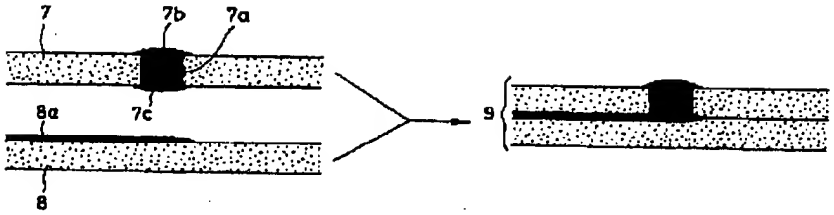
【図1】


アルミナ
a
バインダ
b
溶剤
c
グリーンシート生成
S1
スルーホール形成
S2
スルーホール
埋込み印刷（表面）
S3
スルーホール
埋込み印刷（裏面）
S4
配線パターン印刷
S5
積層
S6
熱圧着
S7
焼成
S8
研削
S9
多層配線セラミック基板
S10
次工程へ

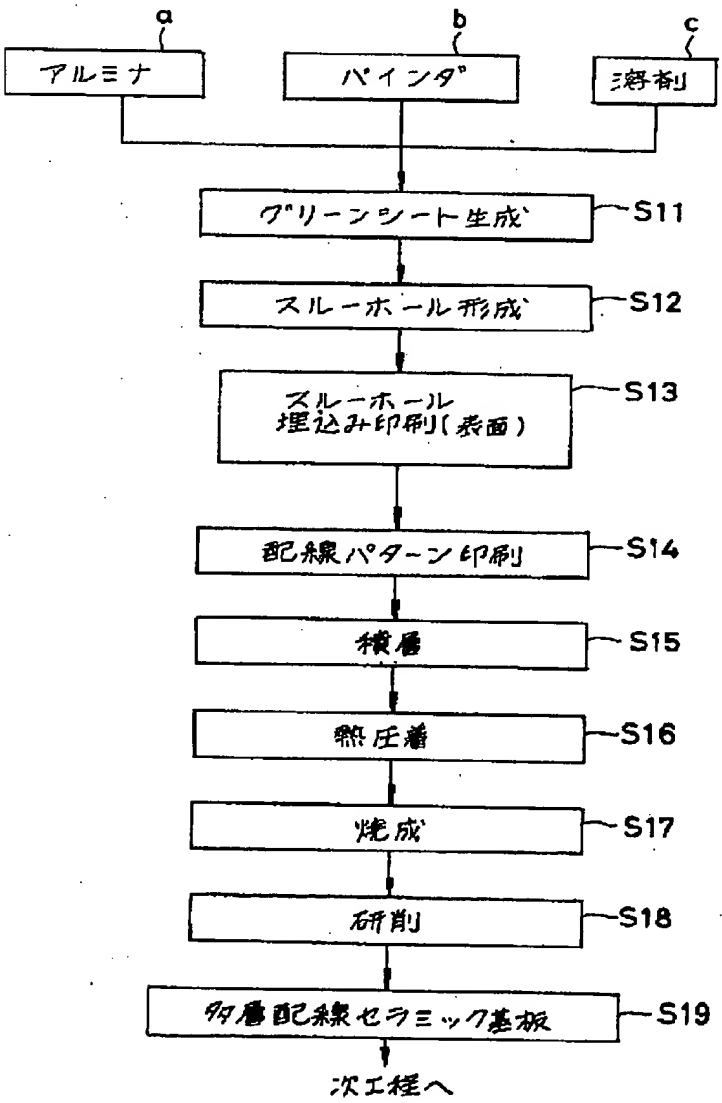
【図4】


2
6
4
3
y
x

【図5】


7
7b
7a
8a
7c
9
8

【図6】


a
b
c
アルミナ
バインダ
溶剤
グリーンシート生成
S11
スルーホール形成
S12
スルーホール
埋込み印刷(表面)
S13
配線パターン印刷
S14
積層
S15
熱圧着
S16
焼成
S17
研削
S18
多層配線セラミック基板
S19
次工程へ

【図7】